INVESTIGATION ON COMPARATIVE ROLES OF MAJOR STAKEHOLDERS FOR BIM IMPLEMENTATION IN A TRADITIONAL CONSTRUCTION PROJECT ENVIRONMENT

A. P. Rathnasinghe and U. Kulatunga

Department of Building Economics, University of Moratuwa, Moratuwa, 10400, Sri Lanka

E-mail: akilapr1993@gmail.com

Abstract: The revolutionary effect of Building Information Modelling (BIM) towards the conventional Architecture Engineering and Construction (AEC) industry has been appraised by many specialists as a constructive force to change AEC's conformist technologies and management principles. Even though BIM has been appraised as an integrator of technology and construction project management, it also has been misguidedly identified in the eyes of many professionals to consider BIM as a '3D model' which is in genuinely, a 'process' to achieve an exceptional alliance in between each construction project stakeholder. However, the complexities in a traditional construction supply chain have far more accelerated with the intervention of BIM where project stakeholders are at an edge of ambiguity to ascertain their supply chain roles and duties in a BIM environment. Therefore, this paper aims to study on roles and duties of BIM project stakeholders concerning the construction supply chain as in BIM Standards and how those standard roles have been embraced in real-life setups. To achieve the aim, comprehensive literature was conducted which is largely based on BIM standards to identify the theoretically established roles and duties of BIM project stakeholders. However, the theoretical aspects may not be the same in real-life scenarios where the project stakeholders may have to alter themselves following the BIM project context. Therefore, BIM expert interviews were directed to extract the opinions of professionals who are virtually involved in the BIM environment to identify how the theoretical aspects had differed. Consequently, this paper acknowledged unsung stakeholders in a theoretical context that are inevitable to consider in actual implementation. Moreover, the experiences of respondents brought up the added duties and responsibilities of stakeholders than identified in BIM standards. Finally, the collected data were illustrated through the cognitive mapping technique which would help the traditional construction project stakeholders to identify and adopt their extended or modified roles to achieve a successful BIM implementation.

Keywords: Building Information Modelling (BIM), BIM Standards, supply chain management, Construction Supply Chain (CSC), construction project stakeholders**.**

1. INTRODUCTION

BIM is being deliberated as the cutting-edge revolution in the construction industry, where Information Technology (IT) and traditional construction techniques have been unified into a collaborative environment (Aouad and Arayici, 2010). Accordingly, numerous viewpoints and features have been conveyed on BIM. However, as to derive the indicated research aim on BIM project stakeholders, the concept of BIM has been defined about the management concept on how the BIM to be implemented as technology in the construction industry.

Even though BIM was in practice for more than 20 years, it is only very a few years ago that the stakeholders of the construction industry were attracted by BIM potentials which promised to makeover the design, construction and operation procedures of buildings in a more rationalized and efficient way (Coates et al., 2010). Subsequently, employers started to insist on architects and other related design and construction experts and contractors to adopt BIM to

achieve the utmost sustainability and cost-efficiency of unique construction outputs (Mihindu and Arayici, 2008).

As in the initial stages, only the prefabricated structural steel production market as a component of the construction industry applied the parametric 3D modeling in its designing process. However, in recent times, a wide range of BIM applications have become freely accessible for professionals in the AEC industry which are considered to be an incentive of the AEC industry's pledge to deploy BIM in the past 20 years (Eastman, Teicholz, Sacks, and Liston, 2011). Therefore, literature significantly highlights, AEC industry's ability to recognize the technological progress in orthodox methods through BIM implementation. This paper comprehends the primary outcomes of the literature synthesis and analysis of data obtained from semi-structured interviews with BIM experts in the AEC industry. Accordingly, the literature synthesis has discussed how the traditional stakeholders in the construction project environment affected by BIM and work scopes upon BIM standards as with special particulars to BIM level 02 introduced by the United Kingdom (UK). Consequently, the data extracted from BIM expert interviews were scrutinized to highlight the deviations of stakeholder roles and duties as anticipated in BIM standards.

2.0 RESEARCH METHOD

This research pursues to address the research problem of 'how the traditional construction project stakeholders have been effected through the intervention of BIM and the deviation of work scopes and roles of anticipated stakeholders of BIM standards in an actual implementation'. Accordingly, a qualitative research approach was appraised, as the qualitative methods can be useful in forming thorough studies on incipient concepts and in an instance where the research has an insignificant basis of literature. Consequently, findings of this research are presented in two components of investigative results on literature synthesis and manual content analysis results of BIM experts' interview results. As in conclusion, the collective attempts on two components were presented as a cognitive map on the roles and duties of BIM construction project stakeholders.

2.1 Cognitive Mapping Technique

Eden and Ackerman (1998) highlighted the use of cognitive maps to arrange complex and bulk quantity of data in a more organized manner. Furthermore, Sandelowski (1995) identified the easiness of the decision making the process and determining conclusions through the structured arrangement of cognitive maps. Therefore, the cognitive mapping was used in presenting the discussion outcomes of the data analysis and literature synthesis while arousing the link in between the empirical data and theoretical perspectives.

2.2 Semi-Structured Expert Interviews

For expert interviews, six numbers of professionals who are related and exposed in BIM with construction project environment and professionals who have been involved in studies of BIM were selected. However, the selection of respondents was centered on their involvement in BIM under which CSC stakeholder role of a BIM project. Accordingly, the diversification of respondents was extended up to the roles of Contractor, Consultant, Engineer, Sub-contractor/Supplier, and BIM Standards regulator (The Government).

The basic details and composition of the experts are given in Table 01. As the BIM application for on-site construction in Sri Lanka is in a preliminary stage, it was required to pay an extra effort in finding out the professionals with required practical knowledge and exposure. Therefore, it was later decided to conduct expert interviews with the professionals who had the practical exposure of BIM application in foreign context as well.

Table 01: Composition of BIM Experts

Respondent	Industry Experience (years)	Involvement in BIM under which CSC Stakeholder Role	Based Country
A	20	Contractor	Sri Lanka
B	8	Government Standards Provider	UK
C	10	BIM Consultant	Dubai
D	7	Contractor	Sri Lanka
E	12	BIM Engineer	Dubai
F	8	Supplier/ Sub-Contractor	Dubai

3.0 INFLUENCE OF BIM TOWARDS THE CONSTRUCTION INDUSTRY

De Valence (2010) has described the construction industry as its features of the assorted, extensively spread industry, where the two outputs of the industry are not sharing the same characteristics which are also the uniqueness of the construction industry. In the same way, Fellows, Langford, Newcombe, and Urry (2002) explained the construction industry and its components as of logically aligned organizations, highly intensive on manpower and have derived demand.

Therefore, it is reasonable to identify, that the construction industry holds a greater impact on global economic strategies and produces extremely unique outcomes compared with other industries. However, the recent studies have revealed the construction industry's extreme effort in implementing certain modifications to upsurge the main three criteria of efficiency, value, and sustainability of productions and to reduce lifespan overheads, and overcome interoperability among participants in construction projects (Noor, 2008). Consequently, it is inevitable to notice that those deficiencies have been caused by the late adoption of new technologies to the construction industry where it is still heavily depending on the labor force. Accordingly, many governments have recognized the critical factors that may affect the efficiency of the construction industry (Guillen et al., 2016). As a result, different directorial standards have been hosted that either validate or mandate the use of BIM as a scheme to address on lack of productivity. The compulsory mandating of BIM Level 02 by the United Kingdom (UK) Government can be identified as a recent uprising of BIM deployment to protect the significance of the construction industry (Kassem, Kelly, Dawood, Serginson, and Lockley, 2015). Because of mandating BIM Level 02, the UK government expected to minimize the 80% of construction waste due to accidental decisions which also declare the BIM's prominent nature towards the image of the construction industry as a unique and global economic impact (Noor, 2008).

4.0 LITERATURE FINDINGS ON BIM PROJECT STAKEHOLDERS

It is a mutual verdict among BIM scholars that BIM has created a strict engagement-based atmosphere among the project participants. Takim et al. (2013), suggested that BIM enables more transparency in decision making, reducing the risk factor in decisions, improving data reliability and steadiness of information over the lifecycle of the project. As found in research studies conducted by Fernando, Bañuelos, and Haibo (2014), the majority of the research population has believed that BIM has overcome the challenge of interoperability throughout the project life cycle by 64%.

Accordingly, Sebastian (2011) enlightened that an efficient cooperative setting consisting of multidisciplinary experts can achieve the optimal status in BIM usage. Furthermore, Sebastian (2011) argued that this cooperative environment needs clear administrative definitions of important positions instead of modifications. Moreover, these settings will be effective through the rescheduled contractual relations and re-engineered integration process.

4.1 Characteristics of BIM Project Stakeholders

Recent studies disclosed the need for BIM practitioners to be involved in the successful execution of BIM (Allen Consulting Group, 2010). As stated by Olatunji (2011), with certain changes and training for usual project professionals, experts with the desired professional expertise can be attained. Therefore, stakeholder training should be consistent with the specific requirements of BIM software. Arayici et al. (2012) pointed out that BIM partners should have contemporary leadership abilities with a unique focus on assistance from outside parties. Scientific studies are therefore aimed at effectively redeveloping advisers within the BIM crew that promote the completion of the model's deliverables.

As Ashcraft (2008) proposed, the indivisible dedication and service towards stakeholders in the BIM project is quite crucial when creating a BIM model. The primary objective of such a collaborative climate should be the development of an extensive BIM model with decreased conflicts between project participants. Under BIM overlay by the Royal Institute of British Architects (RIBA, 2012), this point of perspective was again addressed as intended work profiles and services to be performed by the corresponding stakeholders within a BIM project. A study on the above-mentioned facts identified necessity protocols to identify the BIM project team profiles for efficient BIM execution. Nevertheless, the validity of these protocols depends strongly on the background of the project. Wallbank (2011) suggested the compatibility of protocols with BIM CAD standards as a parameter to authenticate the goals of BIM.

4.2 Roles and Responsibilities of BIM Project Stakeholders

The order of the BIM group and the intellectual property rights of its participants will mostly be resolved by the completion of the project. However, by the moment the model is created, the anticipated use of techniques and methods can be assessed. Consequently, the administration of BIM projects with such nature will be done by a panel of BIM experts consisted of BIM architects, BIM managers, model developers, and draftsmen (Olatunji, 2011). Even though particular professional titles in the BIM setting are still unfamiliar with the standard configuration, traditional experts with BIM expertise are still useful as replacements for BIM work profiles. However, many BIM deployment surveys identified the lower level of BIM acceptance by conventional experts such as engineers and developers compared to designers (McGraw-Hill Construction, 2010; NBS, 2012). Accordingly, Sher, Sheratt,

Williams, and Gameson (2009), provided with an alternative to disregard the compact level of BIM acceptance among specialists by providing an evident set of skills for effective BIM processing by practitioners.

As identified by Aranda-Mena, Crawford, Chevez, and Froese (2009), 'project manager' is one of critical BIM project team members which is be distinct with the BIM and technological interference Moreover, studies of Kassem, Iqbal, Kelly, Lockley, and Dawood (2014), highlighted the role of 'BIM coordinator' as the main professional acts in behalf of the client with a professional liability and the job profile has been recognized by the BIM protocol as a central role in CDE.

CIC BIM protocol (2013) suggested that lead designer and BIM coordinator should work together to embrace the contractual obligations related to the BIM model work distribution. Moreover, the protocol recommended on 'BIM manager' on regulating the administrative and procedural rules related to BIM model management to preserve the collaborative nature and the duties attached to the BIM concept. BIM overlay to RIBA (2012), introduced several professional profiles associated with the BIM project team which are significantly different in compared to the traditional project team stakeholders. Accordingly, Table 2 shows on specific profiles in a BIM-enabled construction project team as identified by RIBA BIM overlay.

Table 2: Identified roles and duties of project stakeholders from literature

Job Title	Key duties within the BIM environment
Main Designer/ Architect	The lead designer ensures the co-ordination of various designs involved in a particular BIM environment and most importantly checking the reliability of the information of the model, how that information produced and whether those have amended to the model as produced. Rather than the traditional lead designer role, lead designer in BIM projects makes effective design decisions based on a collaborative working process. Since there is another role called IM engaged with design management, the distinguish points must be established between design management and design leadership.
Client Representative	A descriptive role from the client's party which acts on behalf of the client at every stage. He has the delegated power to make vital project decisions, appointing technical advisors and delivery managers.
Technical Advisors	Assistances regarding the technical aspects of the BIM model are given by the technical advisors to the client or the client's representative. Technical advisors may include the development of the intelligent brief and other in-use aspects, and tactical advisors regarding the project program. RIBA (Royal Institute of British Architects) client advisors execute this role and employed by the client's representative.
Delivery Manager	The delivery manager is accountable for ensuring the regulatory supply chain compatible with the project program. The client's representative forms this role within the BIM team.

(Source: Rathnasinghe et al., 2019)

5.0 EXPERT INTERVIEWS FINDINGS AND DISCUSSION

To investigate on CSC, it is essential to comprehend the stakeholders who would be involved in that CSC. Since their capacity as a part of the project is crucial for an efficacious BIM collaborative environment. Therefore, the respondents were questioned on any transformation of project stakeholders in the BIM environment compared to the traditional construction phenomena.

Sinclair (2012) also suggested that there is a set of BIM related roles which are contrasted to the conventional project members and the differentiation among conventional vs. BIM related roles should be clearly defined. Furthermore, as it was intended the respondents had identified seven main roles as the BIM project stakeholders for the CSC as namely; employer, lead designer, information manager, delivery manager, technical advisors, contractors, and sub-contractors /suppliers. During the interviews, all the respondents clearly stated that the traditional project stakeholders such as engineers, consultants, suppliers, and sub-contractors would apply to the BIM environment with the same capacity and responsibilities. However, they all established that there is an addition of responsibilities to traditional roles as with technological knowledge and some roles related to Information Technology (IT) had been introduced for the effective performance of BIM in technological aspects.

Additionally, Respondent A highlighted the fact on the BIM specific designations such as BIM Information Manager, BIM Coordinator, and BIM Consultant. According to Respondent A, those designations are not required to appoint separate professionals and the traditional dignitaries can hold those with the required level of BIM capability. However, Respondent B was more specific on the roles incorporated in real-life BIM implementation in the UK. Further to that respondent, rather than the IT personnel such as draftsmen, technicians, and BIM modelers, government authorities like **"Digital Built Britain"** is a must for government construction projects to achieve the expected UK standards.

Furthermore, Respondent C has brought upon the contribution of the representative from a BIM software company as an essential stakeholder since their service is required to preserve the common IT platform among every stakeholder of the CSC. Additionally, it was highlighted on the identification of survey companies in the initial stage as a stakeholder in most of Middle East BIM projects. According to Respondent C, this was mainly due to preserving the consistency of work platforms among the different parties involved in the BIM environment.

Accordingly, the following sub-sections discuss in brief on the roles and duties that the respondents have identified that they have experienced in the actual setup of BIM implementation. Further, the identified roles and duties were cross-referred with the literature sources to provide an evidence-based analysis.

5.1 Employer/ Employer's Representative

The majority of the BIM experts (4 out of 6) aroused the significance of the employer's liability towards the successful BIM initiating step as with a comprehensive EIR document. Similarly, respondent A stresses out the following information which gives a clear identification of the expectations of BIM professionals towards the contribution of an employer's in the BIM environment. As identified by Respondent A, depending on the nature of an employer's capability, the input of information to the CSC would differ. And it is not expected by the BIM experts that the employer to have a comprehensive knowledge of BIM but at least a broad view

on what it requires in his side for a smooth BIM implementation. However, BSI (2013) on PAS 1192:2 has not conveyed about such an appointment and it requires the employer to prepare the EIR document within the given instructions.

5.2 Lead Designer

All the respondents have identified the substantial weight in the role of the lead designer within the spectrum of BIM CSC. However, several experts expressed their opinions on the lead designer's role in different perspectives influenced by the duties of a real lead designer which had been observed by them. Respondent A determined the lead designer's role as an integrator of various parties to a common platform where the lead designer is the main planner of virtual construction and the main regulator of necessary BIM standards towards all other stakeholders of the CSC while satisfying any breaches of the information flow.

In addition to that viewpoint, Respondent E determined the role of the lead designer as the only person who is authorized to federate various disjointed information models feed into the Common Data Environment (CDE) and validates the information in CDE by the any of the stakeholders. Further, Respondent E pointed out the nature of the lead designer's role as a facilitator to the other professional bodies who were not achieved sufficient BIM capability. In such an instance, the lead designer should determine the mitigating actions to minimize the course of negative effects for an effective BIM implementation.

Accordingly, the respondents' opinions on the authority to be borne by the lead designer as to whether it is project planning oriented or design management-oriented were similarly aroused in BIM overlay to RIBA (2012) where it suggests the clear distinction to be defined on the decision making authority towards the collaborative environment. Because the information manager is said to hold this authority as identified by the CIC BIM protocol (2013).

5.3 BIM Information Manager

As BIM is a modern evolution to the traditional orthodox of construction, professionals in the industry expect to be guided by the standards for effective implementation. BIM-related standards by various leading institutions perform this service where all the respondents agreed the effect of BIM standards for a successful BIM implementation is inevitable. Therefore, in the interview guideline, it was questioned on the awareness of the BIM Protocol and its content which was answered positively by all the respondents. Hence, BIM Protocol by the UK Construction Industry Council has mandated the appointment of an 'Information Manager' which was known by all the respondents.

However, all the respondents believed in the following information that whether it is essential to appoint a separate professional under this portfolio or an existing BIM professional can overlook the duties of an information manager. Accordingly, it has been denoted that in practical BIM implementation most of the time the BIM information manager would be considered under the designation of the lead designer or project manager where a separate person will not be appointed.

Furthermore, Respondent B identified the duties of an information manager to holds one of the critical issues in BIM implementation on deciding the copyrights of the stakeholders to the BIM model. As BIM is a collaborative effort, the end product of it would be a collection of knowledge, effort, time and pioneering of various professionals which has to be clearly defined

on the boundaries of ownership among each of them. However, empirical data raised a reasonable question on whether it is highly necessitated to appoint a separate professional just only for the management of CDE. In contrast to this opinion, the CIC BIM protocol (2013) mandates the appointment of a professional called ‘information manager' under the main four duties related to the management of CDE and implementation of BIM protocol guidelines.

5.4 Technical Advisors

It is a known fact that BIM is a concept that is heavily involved with IT where the professionals in respective industries and society may not have the ability to understand the core values for a successful implementation. Therefore, Respondents B, E, and F highlighted the roles related to technical assistance. Similarly, Sher et al. (2009) confirmed this phenomenon while highlighting the need for BIM technological capability holders to abstract the effective output of BIM and its informational models. Henceforward, Arayici et al. (2012) acknowledged the role of BIM draftsmen and modelers to the BIM project team as a facilitating body to the professionals in performing the BIM related activities. According to Respondent A, BIM modelers are considered to be the linking channel among the 2D documentation and the BIM models.

Therefore, BIM modeler has to generate, abstract and improve project 2D documentation related to BIM implementation from the BIM models. However, Respondent F specified on representatives from BIM software companies and survey companies as project stakeholder which is a fresh opinion compared with other respondents. Further to him, it is essential to appoint the agents from BIM software companies because during the project implementation all the users are needed to use the same software package which needs to be customized according to the project context. In such a requisite, it is essential to have a representative to seek advice on BIM software to improve project efficiency. Moreover, Respondent F highlighted the UK's practice to appoint survey companies as technical partners through amending the BIM protocol to improve the work consistency of project activities from the initial stage onwards.

5.5 Delivery Manager

All the respondents suggested that the integration of BIM and CSC of a project enables the easiness of procedures related to material logistics. Henceforth, it was questioned on the professional who is responsible if the material logistics is intervened with BIM. Respondent A and B determined that the BIM information manager who would also be called as the project manager is responsible in this field of service. In contrary to that view, Respondents E and D shared the importance of material logistics combined with BIM technology which would attract the construction professionals to implement BIM to achieve more productivity. Hence, they suggested that rather than replacing the delivery manager's role upon the information manager, it would be more efficient to appoint a BIM modeler on this task. It was further justified by them as the BIM modeler's task is combined with creating the geometry to BIM models and feeding information to the BIM models, it would be more explicable by asking them to perform that duty.

5.6 Contractors and Suppliers

All the respondents believed that the contractor and his parties; sub-contractors and suppliers play a vital role in CSC of a BIM project. It was further justified by them upon the collaborative

nature of BIM which pressures all the project stakeholders to actively participate in the due course of the project whether they are appointed by the employer or not. To discuss the role of the main contractor in CSC of a BIM project, it is necessary to investigate how the 'most suitable' contractor would be selected among bidders in a BIM project. In answer to this issue, Respondent A specified that the contractor selection in a BIM project is the same as in the traditional procurement pathway where it evaluates the capabilities of the respective bidders and the BIM is a component of this evaluation which has to be measured. Furthermore, Respondent A suggested that this evaluation be done as a pre-qualification mechanism upon requesting the respective bidders to submit necessary BIM-related documents.

In addition to that view, Respondent B has commented on the selection of the sub-contractors and suppliers in a BIM environment. Accordingly, it was suggested that the main contractor should verify its parties on their BIM capabilities and whether they are ready for such commitment. Additionally, it was identified on how the recruitment of third parties would be done by the main contractor. The procedure of asking shreds of evidence was suggested to preserve the accuracy of the information supplied and as a guarantee of their BIM capability to the employer.

Furthermore, Respondent C specified the role of sub-contractors and suppliers in the process of BIM model development. It was conveyed that those parties may have the ability to participate in this development upon the main contractor's preference. However, it has to be decided on whether those parties have the actual capabilities on BIM. Hence, in any situation where no such capability is achieved, those parties can outsource this responsibility to another outer party upon the fondness of the project administration.

5.7 Government Authorities

It was highlighted on the aspect of the intervention of government authorities for the successful BIM implementation during the interview process. In the answers for the respective sections of the interview guideline on the BIM project stakeholders, only Respondent B has identified the intervention of government authorities to the BIM project context. NBS (2012) conveyed the exact ideology while expressing the UK government's future expectation towards the inauguration of BIM level 03 to the construction industry.

Further to Respondent B, the UK government has decided to intervene in BIM construction projects which are implemented under Public-Private Partnerships (PPP). It is because the UK government has mandated the BIM utilization in the construction industry from the last decade onwards where a proper government supervision mechanism on feedback was suggested. Accordingly, Respondent B revealed on such institution which is a collaboration among the UK government and the University of Cambridge, named "Centre for Digital Built Britain". This institution is formed to promote a smart digital economy for the UK construction industry while enhancing the construction professionals' interest with ways of improving productivity and efficiency in projects with the use of digital technologies.

Therefore, government institutions like "Digital Built Britain" can also be considered as the BIM project stakeholders which were an abandoned fact to the rest of BIM experts. However, other respondents also agreed with the Respondent B's view on proper government intervention mechanism to be prepared if the government has mandated the use of BIM technology in the construction process. Therefore, as in a whole picture, Arayici et al. (2012) recommended the

BIM project stakeholders to refine the organization's abilities on BIM through a detailed process involved with the philosophies of BIM scholars.

To illustrate the extracted information from an extensive discussion on the BIM project stakeholders and related literature, a cognitive map was developed as a method of presenting the roles and duties of project stakeholders in a much-structured way while highlighting the inter-relationships among them. Therefore, Figure 1 illustrates the structured arrangement on the discussion of findings related to BIM project stakeholders, and their roles and duties.

Furthermore, the developed cognitive map has mainly concentrated on clarifying the significance of identified BIM project stakeholders concerning their contribution and requirements towards the origination of information flows and outputs. Additionally, the cognitive map has illustrated the interconnections among the information flows and information outputs respectively. The main reason for having such a well-structured cognitive map was to enable the easiness of understanding and come up with conclusions for the enthusiastic audience of construction professionals who are interested in BIM implementation

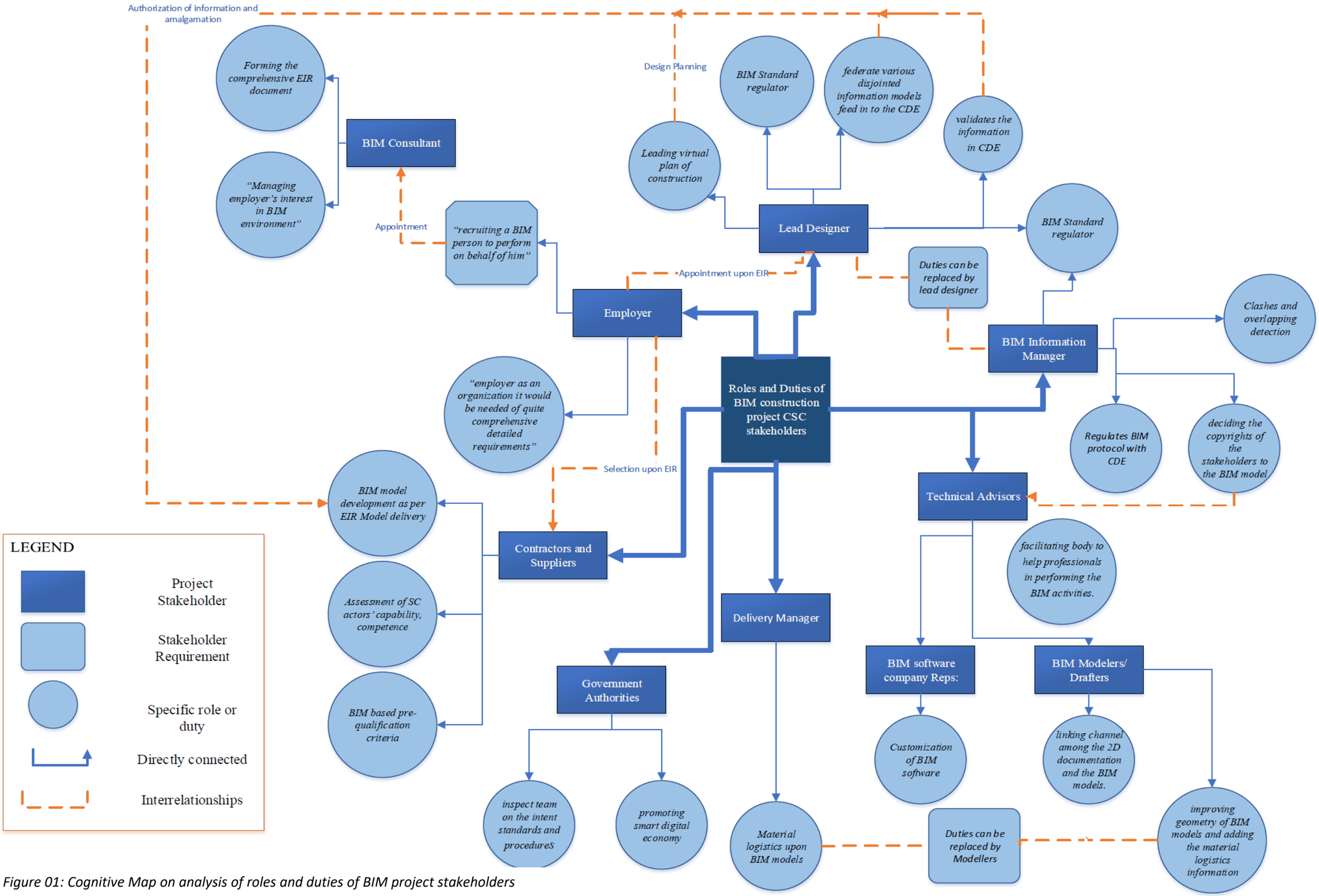

Figure 01: Cognitive Map on analysis of roles and duties of BIM project stakeholders

6.0 CONCLUSIONS

This paper aims to ascertain the deviations in traditional project stakeholders of a BIM project and to acknowledge the identified roles concerning their roles and duties performed during the BIM implementation. In line with this, six number of respondents with BIM actual implementation was questioned on the nature of stakeholders that they have been experienced in a BIM project and whether there were any transformations of traditional characters in such a project. As the final output of this paper, a cognitive map was produced as shown in Figure 01, to illustrate the roles and duties of BIM project stakeholders as a combination of both the literature findings and empirical data. The literature review discovered the standard roles and duties of BIM project stakeholders and the composition of the BIM project team as identified by the regulatory institutions. Accordingly, BIM-related literature exposed to BIM specific job profiles such as; lead architect, client's representative, delivery manager, and technical advisors. Henceforth, the key characteristics of project team members given by the various authors were identified while ascertaining the overlapping of administrative authorities. Accordingly, outcomes of the expert interviews revealed the practical context of BIM project stakeholders where the replacements were identified upon the scarcity of resources and BIM knowledge base. Further, primary data discovered the intervention of professionals that have not been mentioned in standards like 'BIM consultant' as to assist the employer in BIM implementation. Additionally, empirical data revealed the participation of government authorities in countries like the UK where the regulations follow up and promoting the digital technologies to increase the productivity was aimed at. Further, findings of the empirical data highlighted that the conventional roles related to construction would be the same in this context. Moreover, there would be certain additions of duties and responsibilities related to information generation and management. Accordingly, respondents believed that the skilled project members are essential for implementation as the BIM is a high technical related phenomenon where the proper learning of it is needed.

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